

Directions: Show all of your work and clearly indicate your answers. Correct answers with no work may not receive credit.

1. Calculate the iterated integrals

a. $\int_1^2 \int_0^2 (y + 2xe^y) dx dy$

b. $\int_0^1 \int_0^x \cos(x^2) dy dx$

c. $\int_0^\pi \int_0^1 \int_0^{\sqrt{1-y^2}} y \sin(x) dz dy dx$

2. Evaluate $\iint_D xy dA$, where $D = \{(x, y) : 0 \leq y \leq 1, y^2 \leq x \leq y + 2\}$.

3. Evaluate $\iint_D \frac{y}{1+x^2} dA$, where D is bounded by $y = \sqrt{x}, y = 0, x = 1$.

4. Calculate the iterated integral: $\int_0^1 \int_x^1 \cos(y^2) dy dx$.

5. Calculate the iterated integral: $\int_0^1 \int_{\sqrt{y}}^1 \frac{ye^{x^2}}{x^3} dx dy$.

6. Find the volume of the solid under the paraboloid $z = x^2 + 4y^2$ and above the rectangle $R = [0, 2] \times [1, 4]$.

7. Calculate the volume of the solid under the surface $z = x^2y$ that lies above the triangle in the xy -plane with vertices $(1, 0), (2, 1)$ and $(4, 0)$.

8. Evaluate $\iint_D \sqrt{x^2 + y^2} dA$, where D is the region in the first quadrant bounded by the circle $x^2 + y^2 = 2$ and the x - and the y -axes.

9. Evaluate $\iint_D x dA$, where D is the region above the x -axis bounded by the circle $x^2 + y^2 = 9$.

10. Calculate the volume of the solid bounded by the cylinder $x^2 + y^2 = 4$ and the planes $z = 0$ and $y + z = 3$.

11. Evaluate $\int \int \int_E xy \, dV$, where $E = \{(x, y, z) : 0 \leq x \leq 3, 0 \leq y \leq x, 0 \leq z \leq x + y\}$.
12. Evaluate $\int \int \int_E z \, dV$, where E is the solid region bounded by the planes $z = 0$, $z = 1 + x + y$, and the cylinder $x^2 + y^2 = 1$ in the first octant.
13. Find the volume of the solid inside the cylinder $x^2 + y^2 = 4$ under the paraboloid $z = x^2 + y^2$ and above the plane $z = 0$.
14. Evaluate $\int \int \int_E (x^2 + y^2) \, dV$, where E is the solid region above the xy -plane between the spheres $x^2 + y^2 + z^2 = 1$ and $x^2 + y^2 + z^2 = 4$.
15. Evaluate $\int \int \int_E y^2 \sqrt{x^2 + y^2 + z^2} \, dV$, where E is the solid region in the first octant inside the sphere $x^2 + y^2 + z^2 = 1$.
16. Find the area of the cardioid $r = 4 + 3 \cos(\theta)$.
17. Find the area of one petal of the polar rose $r = \cos(3\theta)$.
18. Find the volume of the solid region bounded below by the cone $z = \sqrt{x^2 + y^2}$ and above by the sphere $x^2 + y^2 + z^2 = 1$. (This region is sometimes called an *ice cream cone*.)